Subpart P—Emission Regulations for Otto-Cycle Heavy-Duty Engines, New Methanol-Fueled Natural Gas-Fueled, and Liquefied Petroleum Gas-Fueled Diesel-Cycle Heavy-Duty Engines, New Otto-Cycle Light-Duty Trucks, and New Methanol-Fueled Natural Gas-Fueled, and Liquefied Petroleum Gas-Fueled Diesel-Cycle Light-Duty Trucks; Idle Test Procedures

AUTHORITY: Secs. 202, 206, 207, 208, 301(a), Clean Air Act, as amended 42 U.S.C. 7521, 7525, 7541, 7542, and 7601.

SOURCE: 48 FR 52252, Nov. 16, 1983, unless otherwise noted.

§86.1501–90 Scope; applicability.

This subpart contains gaseous emission idle test procedures for gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, and for gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks. It applies to 1990 and later model years.

[54 FR 14611, Apr. 11, 1989]

§86.1501–94 Scope; applicability.

(a) This subpart contains gaseous emission idle test procedures for light-duty trucks and heavy-duty engines for which idle CO standards apply. It applies to 1994 and later model years. The idle test procedures are optionally applicable to 1994 through 1996 model year natural gas-fueled and liquified petroleum gas-fueled light-duty trucks and heavy-duty engines.

(b) References in this subpart to engine families and emission control systems shall be deemed to refer to durability groups and test groups as applicable for manufacturers certifying new light-duty trucks under the provisions of subpart S of this part.

[64 FR 23923, May 4, 1999]

§86.1502–84 Definitions.

The definitions in §86.084–2 or §86.1803–01, as applicable, apply to this subpart.

[64 FR 23923, May 4, 1999]

§86.1503–84 Abbreviations.

The abbreviations in §86.084–3 or in §86.1804–01, as applicable, apply to this subpart.

[64 FR 23923, May 4, 1999]

§86.1504–90 Section numbering; construction.

(a) The model year of initial applicability is indicated by the section number. The two digits following the hyphen designate the first model year for which a section is effective. A section remains effective until superseded.

Example: Section 86.1511–84 applies to the 1984 and subsequent model years until superseded. If §86.1511–85 is promulgated, it would take effect beginning with the 1985 model year. Section 86.1511–83 would apply to model years 1983 and 1984.

(b) A section reference without a model year suffix refers to the section applicable for the appropriate model year.

(c) All provisions in this subpart apply to gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, and to gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks.

[54 FR 14611, Apr. 11, 1989]

§86.1504–94 Section numbering; construction.

(a) The model year of initial applicability is indicated by the section number. The two digits following the hyphen designate the first model year for which a section is effective. A section remains effective until superseded.

Example: Section 86.1511–84 applies to the 1984 and subsequent model years until superseded. If §86.1511–85 is promulgated, it would take effect beginning with the 1985 model year. Section 86.1511–83 would apply to model years 1983 and 1984.

(b) A section reference without a model year suffix refers to the section applicable for the appropriate model year.

(c) All provisions in this subpart apply to gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, methanol-fueled Diesel-cycle heavy-duty engines, new Otto-cycle light-duty trucks, and liquefied petroleum gas-fueled, natural gas-fueled, and

methanol-fueled diesel-cycle light-duty trucks.

[59 FR 48536, Sept. 21, 1994, as amended at 60 FR 34376, June 30, 1995]

§ 86.1505–84 Introduction; structure of subpart.

(a) This subpart describes the equipment and the procedures required to perform idle exhaust emission tests on gasoline-fueled heavy-duty engines and gasoline-fueled light-duty trucks. Subpart A sets forth the testing requirements, reporting requirements, and test intervals necessary to comply with EPA certification procedures.

(b) Four topics are addressed in this subpart. §§ 86.1505–84 through 86.1515–84 set forth specifications and equipment requirements; §§ 86.1516–84 through 86.1526–84 discuss calibration methods and frequency; test procedures and data requirements are listed in §§ 86.1527–84 through 86.1542–84; and calculation formulae are found in § 86.1544–84.

§ 86.1505–90 Introduction; structure of subpart.

(a) This subpart describes the equipment and the procedures required to perform idle exhaust emission tests on gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, and gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks. Subpart A sets forth the testing requirements, reporting requirements and test intervals necessary to comply with EPA certification procedures.

(b) Four topics are addressed in this subpart. Sections 86.1505 through 86.1515 set forth specifications and equipment requirement; §§ 86.1516 through 86.1526 discuss calibration methods and frequency; test procedures and data requirements are listed in §§ 86.1527 through 86.1542 and calculation formula are found in § 86.1544.

[54 FR 14611, Apr. 11, 1989]

§ 86.1505–94 Introduction; structure of subpart.

(a) This subpart describes the equipment and the procedures required to perform idle exhaust emission tests on heavy-duty engines and light-duty trucks. Subpart A of this part sets forth the testing requirements, reporting requirements and test intervals necessary to comply with EPA certification procedures.

(b) Four topics are addressed in this subpart. Sections 86.1505 through 86.1515 set forth specifications and equipment requirements; §§ 86.1516 through 86.1526 discuss calibration methods and frequency; test procedures and data requirements are listed in §§ 86.1527 through 86.1542 and calculation formulas are found in § 86.1544.

[59 FR 48536, Sept. 21, 1994, as amended at 60 FR 34376, June 30, 1995]

§ 86.1506–90 Equipment required and specifications; overview.

(a) This subpart contains procedures for performing idle exhaust emission tests on gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, and gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks. Equipment required and specifications are as follows:

(1) *Exhaust emission tests.* All engines and vehicles subject to this subpart are tested for exhaust emissions. Necessary equipment and specifications appear in §§ 86.1509 through 86.1511.

(2) *Fuel and analytical tests.* Fuel requirements for idle exhaust emission testing are specified in § 86.1513. Analytical gases are specified in § 86.1514.

(b) [Reserved]

[54 FR 14612, Apr. 11, 1989]

§ 86.1506–94 Equipment required and specifications; overview.

(a) This subpart contains procedures for performing idle exhaust emission tests on Otto-cycle heavy-duty engines and Otto-cycle light-duty trucks. Equipment required and specifications are as follows:

(1) *Exhaust emission tests.* All engines and vehicles subject to this subpart are tested for exhaust emissions. Necessary equipment and specifications appear in §§ 86.1509 through 86.1511.

(2) *Fuel and analytical tests.* Fuel requirements for idle exhaust emission testing are specified in § 86.1513. Analytical gases are specified in § 86.1514.

(b) [Reserved]

[59 FR 48536, Sept. 21, 1994]

§86.1509–84 Exhaust gas sampling system.

(a) The exhaust gas sampling system shall transport the exhaust sample from the engine or vehicle to the analysis system in such a manner as to maintain the integrity of the sample constituents that are to be analyzed.

(b) The sample system shall supply a dry sample (i.e., water removed) to the analysis system.

(c) A CVS sampling system with bag analysis as specified in §86.1309 or §86.109 or with continuous analysis as specified in §86.1310 is permitted as applicable. The inclusion of an additional raw carbon dioxide (CO_2) analyzer as specified in §§86.309–79 and 86.316–79 is required if the CVS system is used, in order to accurately determine the CVS dilution factor. The heated sample line specified in §86.309–79 and §86.310–79 for raw emission requirements is not required for the raw CO_2 measurement.

(d) A raw exhaust sampling system as specified in §86.309–79 and §86.310–79 is permitted.

[48 FR 52252, Nov. 16, 1983, as amended at 60 FR 34376, June 30, 1995]

§86.1511–84 Exhaust gas analysis system.

(a) Analyzers used for this subpart shall meet the following specifications:

(1) The analyzer used shall conform to the emission measurement accuracy provisions of §86.1338.

(2) The resolution of the readout device(s) for the range specified in paragraph (a)(1) of this section shall be equal to or less than 0.05 percent for the CO analyzer.

(3) For the range specified in paragraph (a)(1) of this section, the precision shall be less than ±3 percent of full-scale deflection. The precision is defined as two times the standard deviation of five repetitive responses to a given calibration gas.

(4) For the range specified in paragraph (a)(1) of this section, the mean response to a zero calibration gas shall not exceed ±3 percent of full-scale deflection during a 1-hour period.

(5) For the range specified in paragraph (a)(1) of this section the drift of the mean calibration response shall be less than ±3 percent of full scale during a 1-hour period. The calibration response is defined as the analyzer response to a calibration gas after the analyzer has been spanned by the electrical spanning network at the beginning of the 1-hour period.

(6) The analyzer must respond to an instantaneous step change at the entrance to the sampling system with a response equal to 90 percent of that step change within 15 seconds or less on the range specified in paragraph (a)(1) of this section. The step change shall be at least 60 percent of full-scale deflection.

(7) The interference gases listed shall individually or collectively produce an analyzer reading less than ±2 percent of full scale on the range specified in paragraph (a)(1) of this section.

Interference gas	Concentration	Applicable analyzer
CO_2	14 percent	CO
C_3H_8	1 percent	CO
H_2O	Saturated vapor at 100° F	CO
NO_X	1,000 ppm	CO
O_2	5 percent	CO

(8) The analyzer shall be able to meet the specifications in paragraph (a) of this section under the following conditions:

(i) After a 30 minute warm-up from the prevailing ambient conditions;

(ii) Between 0 to 85 percent relative humidity; and

(iii) During variations of ±50 percent of nominal sample flow.

(b) The inclusion of a raw CO_2 analyzer as specified in §86.309–79 and §86.316–79 is required in order to accurately determine the CVS dilution factor.

[48 FR 52252, Nov. 16, 1983, as amended at 60 FR 34377, June 30, 1995]

§86.1513–90 Fuel specifications.

The requirements of this section are set forth in §86.1313–90(a) for heavy-duty engines, and in §86.113–90(a) for light-duty trucks.

[53 FR 478, Jan. 7, 1988]

§86.1513–94 Fuel specifications.

The requirements of this section are set forth in §86.1313–94 for heavy-duty

engines and in §86.113–94 for light-duty trucks.

[59 FR 48536, Sept. 21, 1994]

§ 86.1514–84 Analytical gases.

(a) The final idle emission test results shall be reported as percent for carbon monoxide on a dry basis.

(b) If the raw CO sampling system in §86.309–79 is used, the analytical gases specified in §86.308–79 shall be used.

(c) If a CVS sampling system is used, the analytical gases specified in §86.1314 shall be used.

[48 FR 52252, Nov. 16, 1983, as amended at 51 FR 24613, July 7, 1986; 60 FR 34377, June 30, 1995]

§ 86.1516–84 Calibration; frequency and overview.

(a) Calibrations shall be performed as specified in §§86.1518–84 through 86.1526–84.

(b) At least monthly or after any maintenance which could alter calibration, check the calibration of the CO analyzer. Adjust or repair the analyzer as necessary.

(c) Water traps, filters, or conditioning columns should be checked before each test.

§ 86.1519–84 CVS calibration.

If the CVS system is used for sampling during the idle emission test, the calibration instructions are specified in §86.1319–84 for heavy-duty engines, and §86.119–78 for light-duty trucks.

§ 86.1522–84 Carbon monoxide analyzer calibration.

(a) *Initial check.* (1) Follow good engineering practice for instrument start-up and operation. Adjust the analyzer to optimize performance on the range specified in §86.1511–84(a)(1).

(2) Calibrate the analyzer with the calibration gas specified in §86.1514–84.

(3) Adjust the electrical span network such that the electrical span point is correct when the analyzer reads the calibration gas correctly.

(4) Determine that the analyzer complies with the specifications in §86.1511–84.

(b) *Periodic check.* Follow paragraphs (a) (1), (2), and (3) of this section as specified by §86.1516–84(b). Adjust or repair the analyzer as necessary.

§ 86.1524–84 Carbon dioxide analyzer calibration.

(a) The calibration requirements for the dilute-sample CO_2 analyzer are specified in §86.1324–84 for heavy-duty engines and §86.124–78 for light-duty trucks.

(b) The calibration requirements for the raw CO_2 analyzer are specified in §86.330–79.

§ 86.1526–84 Calibration of other equipment.

Other test equipment used for testing shall be calibrated as often as necessary according to good engineering practice.

§ 86.1527–84 Idle test procedure; overview.

(a) The idle emission test procedure is designed to determine the raw concentration (in percent) of CO in the exhaust flow at idle. The test procedure begins with the engine at normal operating temperature. (For example, the warm-up for an engine may be the transient engine or chassis dynamometer test.)

(b) Raw emission sampling must be made before dilution occurs from a single exhaust pipe in which exhaust products are homogeneously mixed. The configuration for dual-exhaust systems must also allow for raw emission measurements, which will require that an additional ''Y'' pipe be placed in the exhaust system before dilution.

§ 86.1530–84 Test sequence; general requirements.

(a) The following test sequence lists the major steps encountered during the idle test:

Preparation
Warm-up (or Emission Test)
Preconditioning, 30 seconds minimum, six minutes maximum
Idle Stabilization, 30±5 seconds
Idle Emission Sampling, one minute minimum, six minutes maximum

These steps are described by subsequent procedures.

(b) Ambient test cell conditions during the test shall be those specified in §86.1330–84 or §86.130–78.

§86.1537–84 Idle test run.

The following steps shall be taken for each test:

(a) Check the device(s) for removing water from the exhaust sample and the sample filter(s). Remove any water from the water trap(s). Clean and replace the filter(s) as necessary.

(b) Set the zero and span points of the CO analyzer with the electrical spanning network or with analytical gases.

(c) Achieve normal engine operating condition. The transient engine or chassis dynamometer test is an acceptable technique for warm-up to normal operating condition for the idle test. If the emission test is not performed prior to the idle emission test, a heavy-duty engine may be warmed-up according to §86.1332–84(d)(2) (i) through (iv). A light-duty truck may be warmed up by operation through one Urban Dynamometer Driving Schedule test procedure (see §86.115–78 and appendix I to this part).

(d) Operate the warm engine at 2500 ±50 rpm, or rated torque speed for diesel-cycle engines, and zero load for a minimum of 30 seconds and a maximum of 6 minutes.

(e) If the CVS sampling system is used, the following procedures apply:

(1) If bag samples are drawn, with the sample selector valves in the standby position connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(2) Start the CVS (if not already on), the sample pumps, integrators, and the raw CO_2 analyzer, as applicable. (The heat exchanger of the constant volume sampler, if used, shall be running at operating temperature before sampling begins.)

(3) Adjust the sample flow rates to the desired flow rate and set the gas flow measuring devices to zero.

(4) Operate the engine or vehicle at curb idle for 30±5 seconds with the clutch disengaged or in neutral gear. A heavy-duty engine may also be disconnected from the dynamometer, or the dynamometer may be shut off.

(5) Begin raw and dilute sampling.

(6) For bag sampling, sample idle emissions long enough to obtain a sufficient bag sample, but in no case shorter than 60 seconds nor longer than 6 minutes. Follow the sampling and exhaust measurements requirements of §86.340–79(e) for the conducting of the raw CO_2 measurement.

(7) As soon as possible, transfer the idle test exhaust and dilution air samples to the analytical system and process the samples according to §86.1540–84. Obtain a stabilized reading of the exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(f) If the raw exhaust sampling and analysis technique specified in §86.309–79 is used, the following procedures apply:

(1) Warm up the engine or vehicle per paragraphs (c) and (d) of this section. Operate the engine or vehicle at the conditions specified in paragraph (e)(4) of this section.

(2) Follow the sampling and exhaust measurement requirements of §86.340–79(e). The idle sample shall be taken for 60 seconds minimum, and no more than 64 seconds. The chart reading procedures of §86.343–79 shall be used to determine the analyzer response.

(g) If the engine or vehicle stalls at any time during the test run, the test is void.

[48 FR 52252, Nov. 16, 1983, as amended at 60 FR 34377, June 30, 1995]

§86.1540–84 Idle exhaust sample analysis.

(a) Record the CO idle concentrations in percent.

(b) If the CVS sampling system is used, the analysis procedures for dilute CO and CO_2 specified in §86.1340–84 apply. Follow the raw CO_2 analysis procedure specified in §86.343–79 for the raw CO_2 analyzer.

(c) If the continuous raw exhaust sampling technique (§86.309–79) is used, the analysis procedures for CO specified in §86.343–79 apply.

§86.1542–84 Information required.

(a) *General data—heavy-duty engines.* Information shall be recorded for each idle emission test as specified in §86.1344–84 (b), (c), and (d). The following test data is required:

(1) Date and time of day.

(2) Test number.

(3) Engine intake air or test cell temperature.

(4) Barometric pressure.

NOTE: A central laboratory barometer may be used: *Provided,* That individual test cell barometric pressures are shown to be within ±0.1 percent of the barometric pressure at the central barometer location.

(5) Engine intake or test cell and CVS dilution air humidity.

(6) Curb idle speed during the test.

(7) Idle exhaust CO concentration (dry basis).

(8) Idle exhaust raw CO_2 concentration (if applicable).

(9) Dilute bag sample CO and CO_2 concentrations (if applicable).

(10) Total CVS flow rate with calculated dilution factor for the idle mode (if applicable).

(b) *General data—light-duty trucks.* The following information shall be recorded with respect to each test:

(1) Test number.

(2) System or device tested (brief description).

(3) Date and time of day for the test.

(4) Instrument operated.

(5) Vehicle: ID number, manufacturer, model year, standards, engine family, evaporative emissions family, basic engine description (including displacement, number of cylinders, turbocharger used and catalyst usage), fuel system (including number of carburetors, number of carburetor barrels, fuel injection type and fuel tank(s) capacity and location), engine code, gross vehicle weight rating, inertia weight class and transmission configuration, as applicable.

(6) All pertinent instrument information such as tuning, gain, serial number, detector number and range. As an alternative a reference to a vehicle test cell number may be used, with the advance approval of the Administrator, provided test cell calibration records show the pertinent instrument information.

(7) Recorder charts or computer printouts: Identify zero, span, exhaust gas and dilution air sample traces or computer readings (if applicable).

(8) Test cell ambient temperature and, if applicable, barometric pressure and humidity.

NOTE: A central laboratory barometer may be used: *Provided,* That individual test cell barometric pressures are shown to be within = 0.1 percent of the barometric pressure at the central barometer location.

(9) Pressure of the mixture of exhaust and dilution air entering the CVS metering device (or pressure drop across the CFV), the pressure increase across the device, and the temperature at the inlet (if applicable). The temperature may be recorded continuously or digitally to determine temperature variations (if applicable).

(10) The number of revolutions of the positive displacement pump accumulated while exhaust samples are being collected (if applicable). The number of standard cubic feet metered by a critical flow venturi would be the equivalent record for a CFV (if applicable).

(11) The humidity of the dilution air.

NOTE: If conditioning columns are not used (see §§ 86.122 and 86.144) this measurement can be deleted. If the conditioning columns are used and the dilution air is taken from the test cell, the ambient humidity can be used for this measurement.

(12) Curb idle engine speed during the test.

(13) Idle exhaust CO concentration (dry basis).

(14) Idle exhaust raw CO_2 concentration (if applicable).

(15) Dilute bag sample CO and CO_2 concentrations (if applicable).

(16) Total CVS flow rate with calculated dilution factor for the idle mode (if applicable).

[48 FR 52252, Nov. 16, 1983, as amended at 49 FR 48149, Dec. 10, 1984]

§ 86.1544–84 Calculation; idle exhaust emissions.

(a) The final idle emission test results shall be reported as percent for carbon monoxide on a dry basis.

(b) If a CVS sampling system is used, the following procedure shall apply:

(1) Use the procedures, as applicable, in § 86.1342–84 to determine the dilute wet-basis CO and CO_2 in percent.

(2) Use the procedure, as applicable, in § 86.345–79 to determine the raw dry-basis CO_2 in percent.

(3) Convert the raw dry-basis CO_2 to raw wet-basis. An assumption that the percent of water by volume in the raw sample is equal to the percent of raw dry-basis CO_2 minus 0.5 percent is acceptable. For example:

10.0% dry $CO_2 - 0.5\% = 9.5\%$ water

$(1.00 - 0.095)$ (10.0% dry CO_2) = 9.05% wet CO_2

(4) Calculate the CVS dilution factor (DF) by:

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(5) Convert the dilute wet-basis CO to dilute dry-basis values. An assumption that the percent of water by volume in the sample bag is 2 percent is acceptable. For example:

Dilute dry CO=(dilute wet CO)/(1.00–0.02)

(6) Calculate the raw dry-basis CO values by:

Raw dry CO=(DF) (dilute dry CO)

(c) If the raw exhaust sampling and analysis system specified in § 86.309–79 is used, the percent for carbon monoxide on a dry basis shall be calculated using the procedure, as applicable, in § 86.345–79.

(Secs. 202, 203, 206, 207, 208, 301a, Clean Air Act, as amended; 42 U.S.C. 7521, 7522, 7525, 7541, 7542, 7601a)

[48 FR 52252, Nov. 16, 1983, as amended at 49 FR 48149, Dec. 10, 1984; 50 FR 10708, Mar. 15, 1985; 51 FR 24613, July 7, 1986]